1. JP,2675405,B

CLAIMS

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(57) [Claim(s)]
[Claim 1] In the exhaust gas purge of the engine which equipped the engine exhaust air system with the NOX clarification catalyst from which the rate of clarification of NOX serves as a peak when exhaust gas temperature is a predetermined temperature region While taking out exhaust gas from the upstream and the downstream of said NOX clarification catalyst and making it flow back to an inhalation-of-air system The EGR equipment which switches the reflux from the upstream of said NOX clarification catalyst, and the reflux from the downstream, While making exhaust gas flow back from the upstream of said NOX clarification catalyst at the time of engine low loading The exhaust gas purge of the engine characterized by having the EGR control means which controls said EGR equipment to make exhaust gas flow back from the downstream of said NOX clarification catalyst at the time of an engine heavy load.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
(Field of the invention on industry)
This invention relates to amelioration of an engine exhaust gas purge.
(Prior art)
Although the amount of HC and CO which are emitted by advance of an exhaust gas clarification technique in recent years into atmospheric air is decreasing, since the cure to NOX is behind, damage, like the acid rain which originates in NOX focusing on the city section falls has occurred.
But although NH3 catalytic reduction method is known as what can purify NOX in exhaust gas, this NH3 catalytic reduction method has a complicated system, and since it has the problem of the secondary public nuisance that NH3 is discharged in the top where cost is high when the temperature of combustion is high, applying to an automobile has many unsolved problems.
On the other hand, although the three way component catalyst method which can purify simultaneously HC, CO, and NOX in exhaust gas with one catalytic converter is also proposed, and this three way component catalyst method is effective near theoretical air fuel ratio, there is a problem [air-fuel ratio / of exhaust gas] that the Lean condition of the clarification engine performance is inadequate.
Then, as recently shown in JP,63-100919,A, the NOX clarification catalyst which contains Cu as a catalyst which can purify NOX under existence of HC is proposed among the oxidizing atmosphere.
(Technical problem which invention tends to solve)
However, as shown in drawing 8 , the clarification engine performance changes with exhaust gas temperatures which pass a catalyst, when exhaust gas temperature is near 500 degree C, the clarification engine performance is a peak, and the clarification catalyst of NOX containing this Cu has the problem that the clarification engine performance falls, at beyond this temperature or below this temperature.
Then, this invention person aimed at reduction of NOX which operate EGR equipment, and exhaust gas is made to flow back to an inhalation-of-air system, and is discharged in exhaust gas at the time of engine low loading and a heavy load, the time when the temperature of exhaust gas is low, and when high that is, and he took into consideration that this compensated the clarification engine performance of said NOX clarification catalyst.
However, according to the exhaust gas purge equipped with this EGR equipment, the clarification capacity of a NOX clarification catalyst is suppliable with EGR equipment in the field in which a NOX clarification catalyst does not fully function, but As a result of low-temperature exhaust gas's flowing back at the time of engine low loading, at the time of the problem that engine flammability is not enough, and an engine heavy load As a result of the reflux of hot exhaust gas, since combustion temperature in a combustion chamber was not fully able to be stopped, the problem that the reduction effectiveness of NOX was not enough was not avoided.
When exhaust gas temperature is a predetermined temperature region in view of the above, this invention aims at aiming at improvement in the reduction effectiveness of a NOX discharge at the time of an engine heavy load while it aims at improvement in engine flammability at the time of engine low loading, compensating the NOX clarification engine performance with EGR equipment at the time of the low loading of an engine with the low clarification engine performance of a NOX clarification catalyst in which the rate of clarification of NOX serves as a peak, and a heavy load.
(The means for solving a technical problem)
While this invention makes the exhaust gas of the elevated-temperature condition before NOX clarification catalyst passage flow back at the time of engine low loading, it makes the exhaust gas of a low-temperature condition flow back with the high specific heat after NOX clarification catalyst passage at the time of an

engine heavy load, in order to attain said object.
The solution means which this invention provided concretely is premised on the exhaust gas purge of the engine which equipped the engine exhaust air system with the NOX clarification catalyst from which the rate of clarification of NOX serves as a peak when exhaust gas temperature is a predetermined temperature region. While taking out exhaust gas from the upstream and the downstream of said NOX clarification catalyst and making it flow back to an inhalation-of-air system The EGR equipment which switches the reflux from the upstream of said NOX clarification catalyst, and the reflux from the downstream, While making exhaust gas flow back from the upstream of said NOX clarification catalyst at the time of engine low loading, at the time of an engine heavy load, it considers as a configuration equipped with the EGR control means which controls said EGR equipment to make exhaust gas flow back from the downstream of said NOX clarification catalyst.
(Operation)
By the configuration of this invention, the amount of NOX(s) discharged in exhaust gas by EGR by EGR equipment can be reduced in the time of the low loading of an engine with the low clarification engine performance of a NOX clarification catalyst, and a heavy load.
Moreover, in order to take out exhaust gas from the upstream of a NOX clarification catalyst at the time of engine low loading, the exhaust gas of an elevated-temperature condition flows back in an inhalation-of-air system.
Furthermore, while the heat capacity of a combustion chamber is raised when the high exhaust gas of the specific heat flows back in an inhalation-of-air system since exhaust gas is taken out from the downstream of a NOX clarification catalyst at the time of an engine heavy load, the exhaust gas which passed the NOX clarification catalyst and changed into the low-temperature condition flows back in an inhalation-of-air system.
(Example)
Hereafter, the example of this invention is explained based on a drawing.
Drawing 1 shows a configuration, when [whole] the exhaust gas purge concerning the 1st example of this invention is applied to diesel-power-plant 10A, and it sets it to this drawing. The intake manifold by which an inlet pipe and 14 supply air to each cylinder of diesel-power-plant 10A in order that 12 may inhale air to diesel-power-plant 10A, The exhaust manifold which collects the fuel injection pump with which 15 carries out injection supply of the fuel at said each cylinder, and the exhaust gas with which 16 is discharged from said each cylinder, and 18 are exhaust pipes which discharge exhaust gas.
Moreover, in this drawing, 20 is a NOX clarification catalyst containing Cu for returning NOX in exhaust gas, and is manufactured as follows. That is, Na of the mordenite [Na2 O-aluminum2O3 and nSiO2] which is a kind of a zeolite is permuted by H, and the mole ratio of SiO2/aluminum 2O3 prepares that whose pole diameter is about 7A, carries out impregnation of this to the water solution of organic-acid copper, makes the ion exchange cause, and makes Cu support or more with ten. In this case, while the rate of clarification of NOX is as high as what has many rates of the copper ion exchange, catalytic activity is so high that the mole ratio of SiO2/aluminum 2O3 is high.
Moreover, compared with other catalysts, its NO resolvability ability is quite high while this NOX clarification catalyst 20 decomposes NO into N2 and O2 by performing a decomposition reaction as shown in 2Cu++NO->2Cu2++NO-->2Cu++N2+O2 and has the high rate of clarification to NO around 500 degrees C as mentioned above. Moreover, this NOX clarification catalyst 20 has the property in which the rate of clarification falls, so that O2 partial pressure is high, and the rate of clarification falls, so that CO partial pressure is low, although the clarification engine performance of NOX has the high air-fuel ratio of exhaust gas in lean atmosphere.
Moreover, in this drawing, it is the burner which burns the particle which 21 was arranged by the exhaust pipe 18 of the upstream of the NOX clarification catalyst 20, and DPF (diesel particulate filter) which carries out uptake of the particle in exhaust gas, and filters it, and 22 were arranged in the wall of the exhaust pipe 18 of the upstream of DPF21, and adhered to DPF21. Thus, since DPF21 is arranged in the upstream of the NOX clarification catalyst 20, uptake of the particle in exhaust gas is carried out by DPF21 and it does not reach the NOX clarification catalyst 20 by it, the clarification performance degradation of the NOX clarification catalyst 20 is prevented. Moreover, since the burner 22 is arranged in the upstream of DPF21, when many particles adhere to DPF21, it will be in a loading condition and exhaust gas stops being able to circulate easily, a particle is burned with a burner 22 and it can remove.
In Figs. 1 and 2 24 Moreover, the exhaust pipe 18 of the upstream of DPF21, i.e., the upstream of the NOX clarification catalyst 20, and the exhaust pipe 18 of the downstream of the NOX clarification catalyst 20,

The EGR path which makes an inlet pipe 12 open for free passage respectively and makes exhaust gas flow back from an exhaust pipe 18 to an inlet pipe 12, 26A and 26B are interposed near the free passage section with the exhaust pipe 18 in the EGR path 24. The EGR valve which makes adjustable respectively the amount of reflux from the upstream of the NOX clarification catalyst 20, and the amount of reflux from the downstream of the NOX clarification catalyst 20, 28A and 28B make the vacuum pump 29 and EGR valves 26A and 26B with which the AC dynamo was equipped open for free passage. The negative pressure installation path which introduces negative pressure into EGR valves 26A and 26B, and 30A and 30B are solenoid valves for EGR which are interposed in the negative pressure installation paths 28A and 28B, and adjust the opening of EGR valves 26A and 26B by duty control.
EGR equipment 32 is constituted by the EGR path 24 and EGR valves 26A and 26B which were explained above, the negative pressure installation paths 28A and 28B, a vacuum pump 29, and the solenoid valves 30A and 30B for EGR, and as a result of exhaust gas's flowing back in an inhalation-of-air system and raising the heat capacity of a combustion chamber by this EGR equipment 32, the NOX discharge to the inside of exhaust gas decreases.
In addition, in this example, inhalation-of-air throttle valve 12a is arranged in the upstream rather than the free passage section with the EGR path 24 in an inlet pipe 12. By the diesel power plant, since the difference of an intake pressure and an exhaust pressure is small, as for the reason, exhaust gas cannot flow into an inlet pipe 12 easily from the EGR path 24. Then, in case exhaust gas is made to flow back, it is for extracting this inhalation-of-air throttle valve 12a, making it a predetermined intake pressure, and carrying out that it is easy to make exhaust gas flow back. But the amount of reflux of exhaust gas is adjusted by adjusting the opening of EGR valves 26A and 26B even in this case.
In drawing 1 , the air pump whose 36 is the supply source of secondary air, and 38 Moreover, the air pump 36, Between DPF21 and the NOX clarification catalysts 20 in an exhaust pipe 18 is made to open for free passage. The secondary air passage for supplying secondary air to an exhaust pipe 18, the secondary air modulating valve which carries out adjustable [of the amount of secondary air in which 40 circulates the secondary air passage 36], It is the solenoid valve for secondary air which 42 makes said vacuum pump 29 and the secondary air modulating valve 40 open for free passage, and the negative pressure installation path which introduces negative pressure into the secondary air modulating valve 40, and 44 are interposed in the negative pressure installation path 42, and adjusts the opening of the secondary air modulating valve 40 by duty control.
With the secondary air pump 36 explained above, the secondary air passage 38, the secondary air modulating valve 40, the negative pressure installation path 42, and the solenoid valve 44 for secondary air The secondary air feeder 46 which supplies secondary air to the upstream of the NOX clarification catalyst 20 is constituted. When [when the air-fuel ratio of exhaust gas is rich] the temperature of exhaust gas is high If secondary air is supplied into exhaust gas by this secondary air feeder 46, while the exhaust gas which flows into the NOX clarification catalyst 20 becomes the Lean inclination, exhaust gas temperature falls, and while protection of the NOX clarification catalyst 20 is achieved, the engine performance of a NOX clarification catalyst will improve.
Moreover, the circulating-water-temperature sensor by which 50 detects engine-cooling-water temperature in drawing 1 , The intake-air-temperature sensor by which 51 detects an engine intake-air temperature, the intake-pressure sensor by which 52 detects an engine intake pressure, The exhaust gas temperature sensor by which 54 detects the exhaust gas temperature of the upstream of the NOX clarification catalyst 20, It is O2 sensor by which 55 detects the oxygen density in exhaust gas, and the pressure sensor with which 56 detects the pressure of exhaust gas, and the condition that many particles adhered to the filter of DPF21 with this pressure sensor 56, and the filter has started loading can be detected.
Moreover, in drawing 1 , while 60 makes exhaust gas flow back from the upstream of the NOX clarification catalyst 20 at the time of engine low loading, it is a control unit with a built-in CPU as an EGR control means which controls EGR equipment 32 to make exhaust gas flow back from the downstream of the NOX clarification catalyst 20 at the time of an engine heavy load.
A control unit 60 From the cooling water temperature sensor 50 to and an engine-cooling-water temperature signal The intake-air-temperature signal of the intake-air-temperature sensor 51 to an engine, the intake-pressure signal of the engine from the intake-pressure sensor 52, The exhaust gas temperature signal from the exhaust gas temperature sensor 54, the air-fuel ratio signal of the exhaust gas from O2 sensor 55, An exhaust-air-pressure force signal, an engine speed signal from a fuel injection pump 15, an engine load signal, etc. from a pressure sensor 56 are received. Based on an exhaust gas temperature signal and an air-fuel ratio signal, duty control of the solenoid valve 44 for secondary air is carried out, and combustion of a

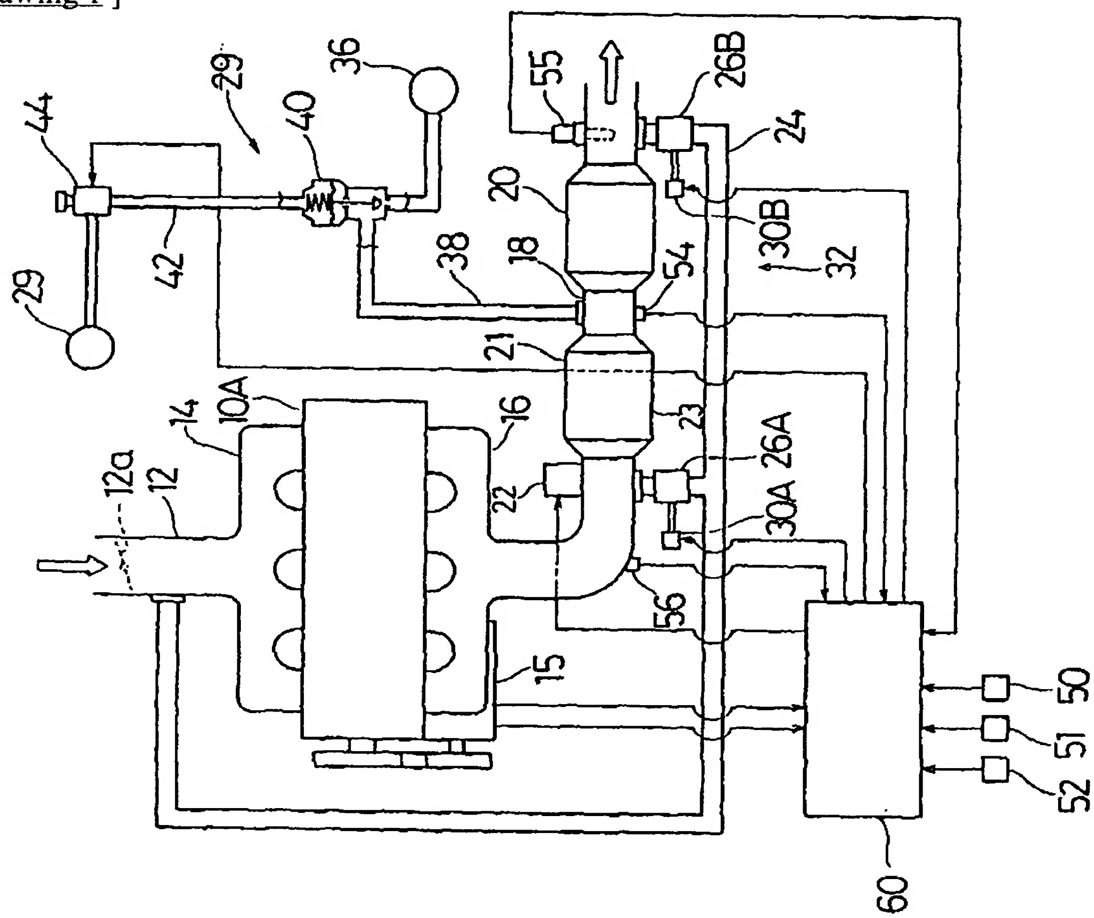
burner 22 is controlled based on the exhaust-air-pressure force signal from a pressure sensor 56.
Moreover, based on an engine load signal and an engine speed signal, as shown in drawing 3 , a control unit 60 Exhaust gas is made to flow back from the downstream of the NOX clarification catalyst 20 at the time of an engine heavy load (for (a) to show this drawing). Exhaust gas is made to flow back from the upstream of a NOX clarification catalyst at the time of engine low loading (for (b) to show this drawing). Either does not make exhaust gas flow back at the time of the inside load of an engine (for (c) to be shown in this drawing), either, or the solenoid valves 30A and 30B for EGR are controlled respectively to carry out little reflux from the downstream. In addition, it may replace with said example and the above control may be performed only based on an engine load signal.
As mentioned above, by EGR equipment 32, when the clarification engine performance of the time of engine low loading and a heavy load, i.e., a NOX clarification catalyst, is low, since the heat capacity of a combustion chamber is raised, while the discharge of NOX to the inside of exhaust gas decreases, the partial pressure of NO in exhaust gas increases, and improvement in the rate of NOX clarification is achieved.
Moreover, since exhaust gas is taken out from the upstream of the NOX clarification catalyst 20 at the time of engine low loading, hot exhaust gas is obtained and this hot exhaust gas flows back in an inhalation-of-air system, improvement in an engine combustion chamber is achieved.
Furthermore, since the exhaust gas which became low temperature by passing the NOX clarification catalyst 20 flows back while the heat capacity of a combustion chamber is raised, as a result of decomposing NOX into O2 and N2 and the high (that is, there is much molecularity) exhaust gas of the specific heat flowing back in an inhalation-of-air system, in order to take out exhaust gas from the downstream of the NOX clarification catalyst 20 at the time of an engine heavy load, blowdown of NOX decreases.
In addition, about the amount of reflux of the exhaust gas by EGR equipment 32, it is desirable to be based on the EGR rate map set up according to a mean effective pressure (it is equivalent to an engine load) as shown in drawing 4 , and an engine rotational frequency.
Figs. 5 and 6 show the case where the exhaust gas purge concerning the 2nd example of this invention is applied to gasoline engine 10B, and an inlet pipe 12, the intake manifold 14, the exhaust manifold 16, the exhaust pipe 18, and the NOX clarification catalyst 20 are arranged like said 1st example.
Moreover, since it is the case where **** 2 example is applied to gasoline engine 10B, since the particle in exhaust gas does not become a problem, DPF21 and a burner 22 are not arranged, but the oxidation catalyst 23 which oxidizes HC and CO in exhaust gas is arranged instead. Therefore, the EGR path 24 is making the exhaust pipe 18 of the upstream of an oxidation catalyst 23 and the exhaust pipe 18 of the downstream of the NOX clarification catalyst 20, and the inlet pipe 12 open for free passage respectively in **** 2 example.
Moreover, in the **** 2 example, the negative pressure installation paths 28A and 28B of EGR equipment 32 and the negative pressure installation path 42 of the secondary air feeder 46 were respectively open for free passage to the inlet pipe 12 of the downstream of inhalation-of-air throttle valve 12a, were replaced with said vacuum pump 29, and have introduced negative pressure from the inlet pipe 12.
Furthermore, while a control unit 60 makes exhaust gas flow back from the upstream of the NOX clarification catalyst 20 at the time of engine low loading like [in response to the engine inhalation negative pressure sensor 58 to an engine speed signal and an engine load signal] the above from an engine speed sensor 57 that is, it controls respectively the solenoid valves 30A and 30B for EGR by **** 2 example to make exhaust gas flow back from the downstream of the NOX clarification catalyst 20 at the time of an engine heavy load.
In addition, when the exhaust gas purge of the engine concerning **** 2 example is applied to gasoline engine 10B, about the amount of reflux of exhaust gas, it is desirable to be based on the EGR rate map set up according to a mean effective pressure as shown in drawing 7 , and an engine rotational frequency.
(The object of invention)
In the exhaust gas purge of the engine which was equipped with the NOX clarification catalyst from which the rate of clarification of NOX serves as a peak when exhaust gas temperature is a predetermined temperature region according to this invention as explained above While making exhaust gas flow back from the upstream of a NOX clarification catalyst at the time of engine low loading Since it was made to make it flow back from the downstream of a NOX clarification catalyst at the time of a heavy load, at the time of the low loading of an engine with the low clarification engine performance of a NOX clarification catalyst, and a heavy load, the amount of NOX(s) discharged in exhaust gas by EGR equipment can be reduced, and the clarification engine performance of a NOX clarification catalyst can be compensated.
Moreover, since the heat capacity taken out from the downstream of a NOX clarification catalyst makes the exhaust gas of a low-temperature condition flow back highly at the time of an engine heavy load while being

able to aim at inflammable improvement in an engine, since the exhaust gas of the elevated-temperature condition taken out from the upstream of a NOX clarification catalyst is made to flow back at the time of engine low loading, reduction of a NOX discharge can be aimed at.

[Translation done.]

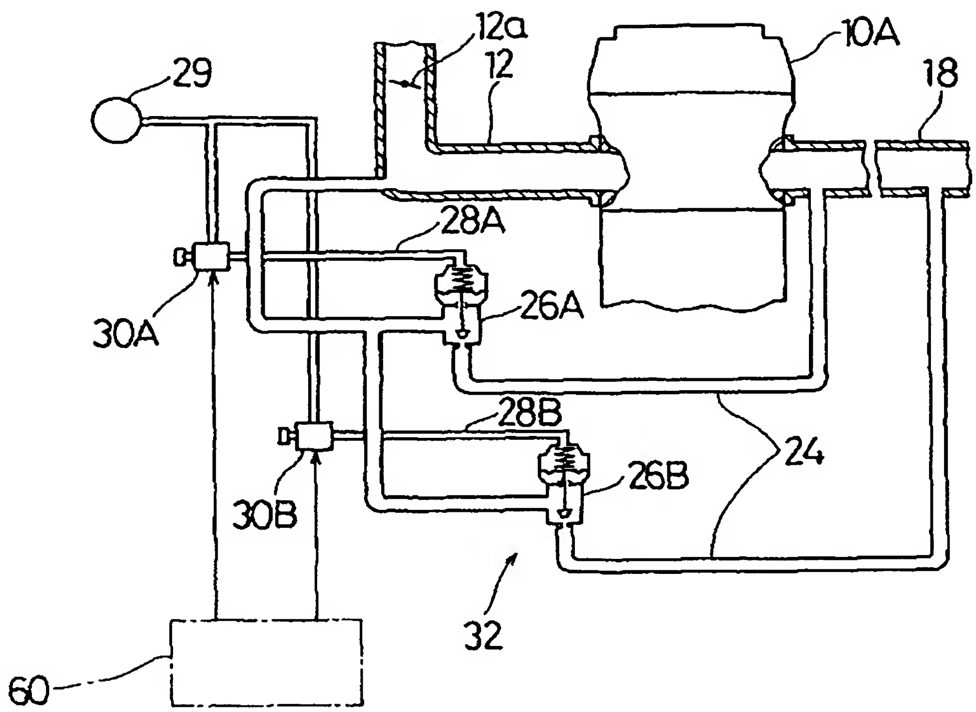
DRAWINGS

[Drawing 1]

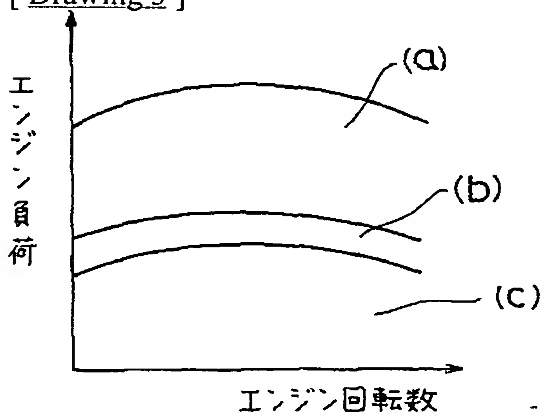


10A…ディーゼルエンジン
10B…ガソリンエンジン
12…吸気管
18…排気管
20…NOx浄化触媒
21…DPF
23…酸化触媒
24…EGR通路
26A，26B…EGRバルブ
28A，28B…負圧導入通路
29…負圧ポンプ
30A，30B…EGR用ソレノイドバルブ
32…EGR装置
60…コントロールユニット

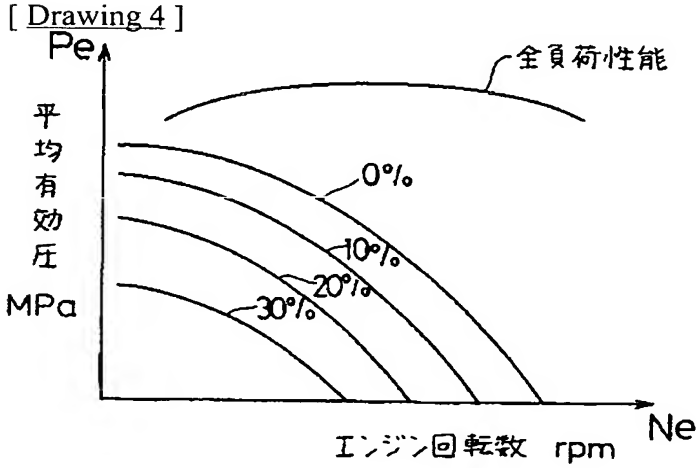
[Drawing 2]



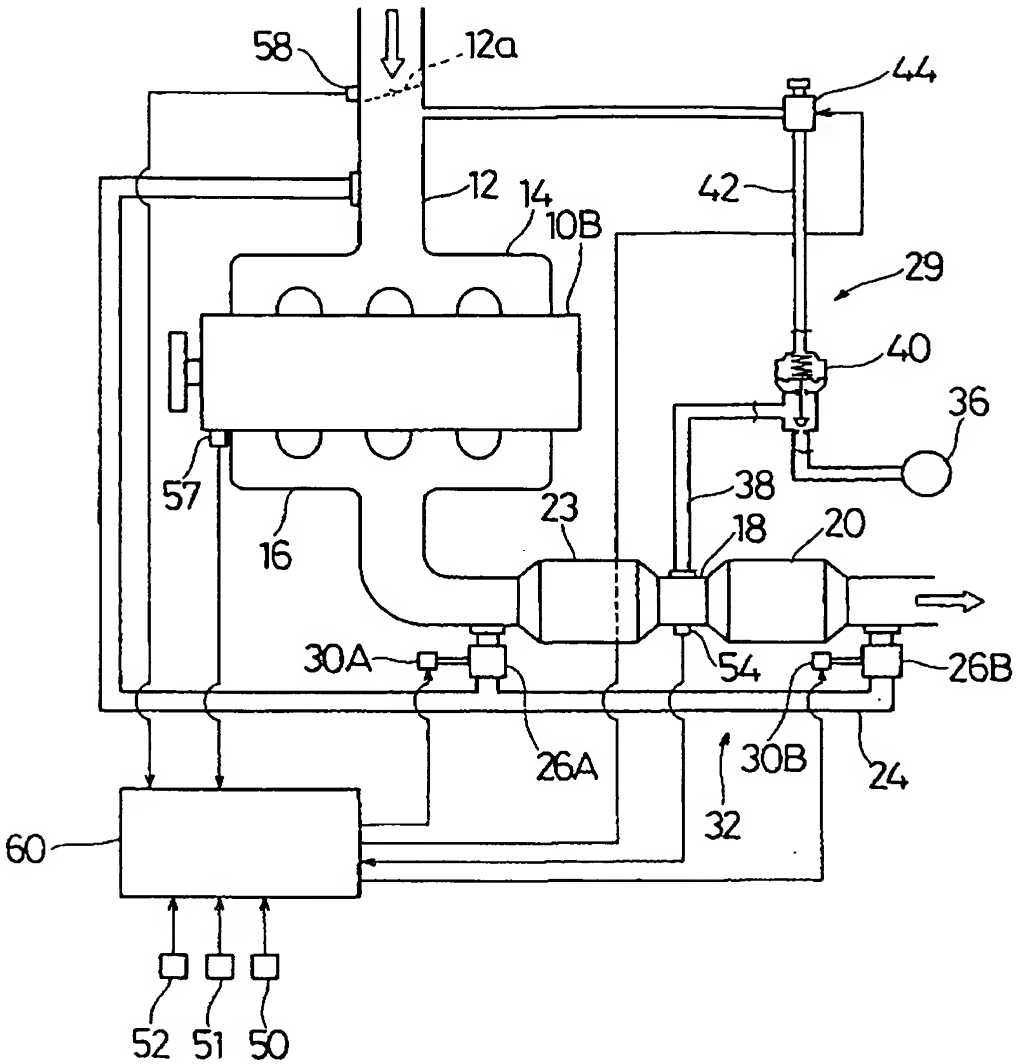
[Drawing 3]



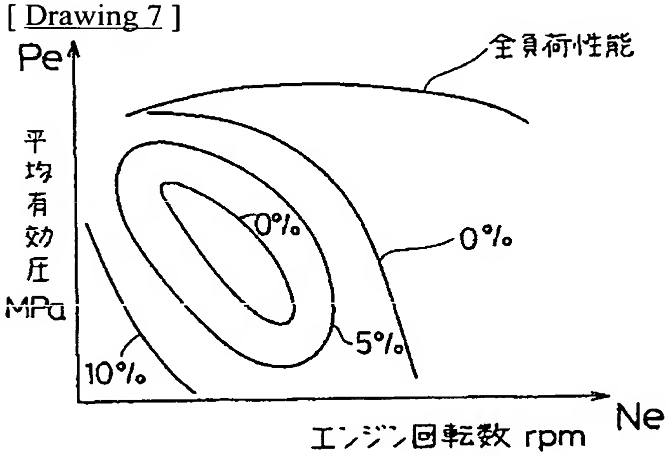
[Drawing 4]



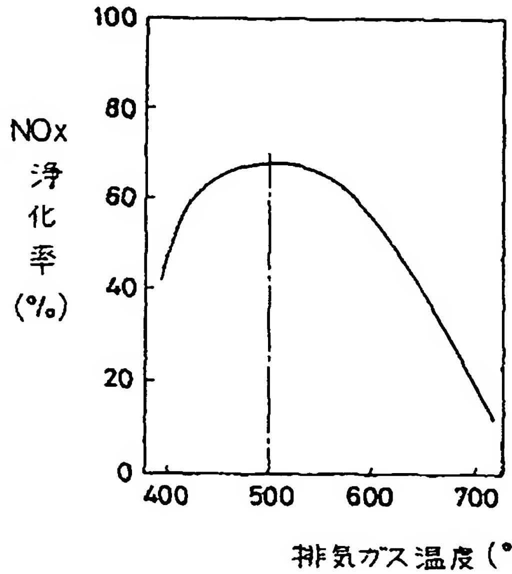
[Drawing 5]



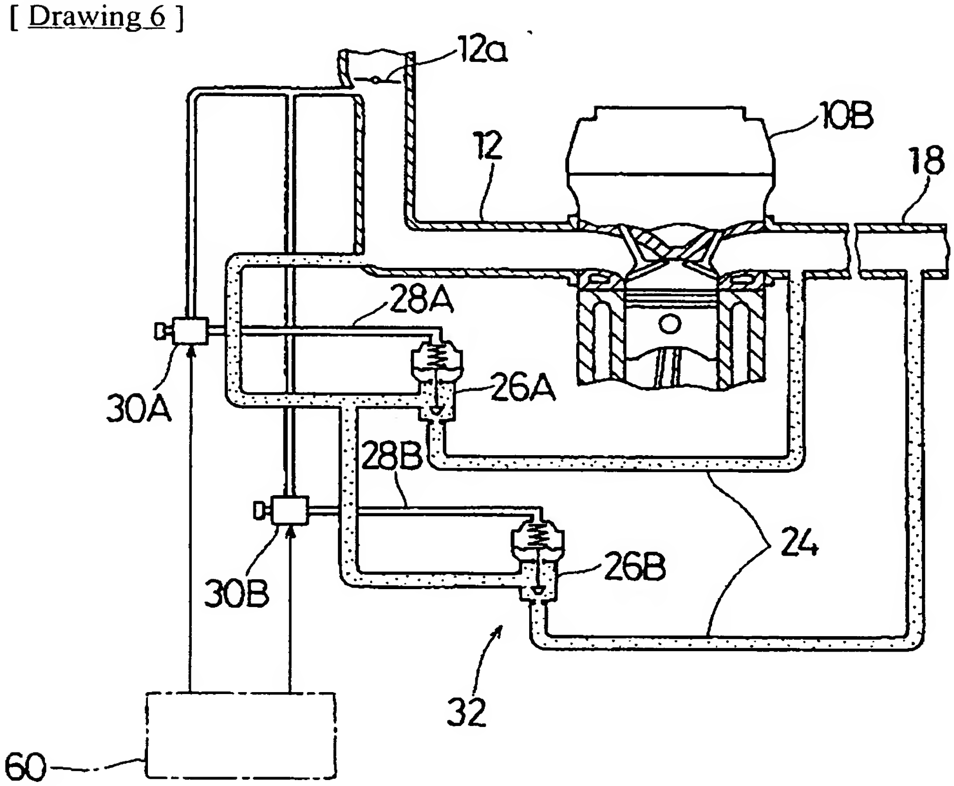
[Drawing 7]



[Drawing 8]



[Drawing 6]



[Translation done.]